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**Kim**

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(54) **DETERGENT SUPPLY APPARATUS AND WASHING MACHINE HAVING THE SAME**

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(57) **ABSTRACT**

(30) **Foreign Application Priority Data**

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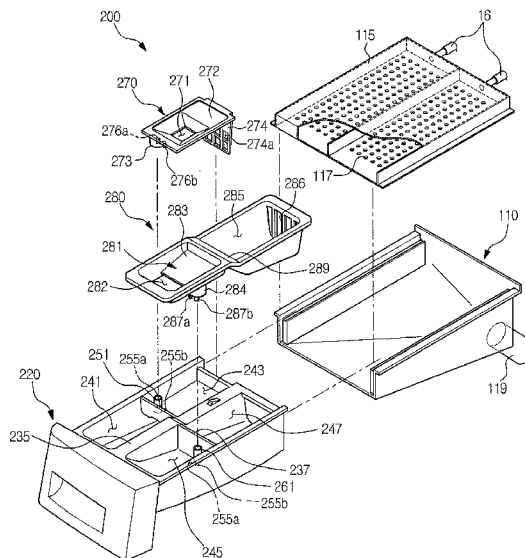
A detergent supply apparatus includes a detergent box; and at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon. The liquid detergent containing unit includes a siphon pipe to induce a siphon action, a siphon cap coupled to the siphon pipe, and at least one residual water hole formed through a bottom of the liquid detergent containing unit. The siphon cap includes at least one cap protrusion configured to be fitted into the residual water hole, and at least one gap is defined between the residual water hole and the cap protrusion such that residual water is discharged from the liquid detergent containing unit through the gap. The liquid detergent containing unit includes at least one integral liquid detergent containing unit integrally provided in the detergent box.

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**D06F 39/02** (2006.01)

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CPC ..... **D06F 39/022** (2013.01); **D06F 39/02** (2013.01)

(58) **Field of Classification Search**  
CPC ..... D06F 39/02; D06F 39/022  
See application file for complete search history.

**10 Claims, 9 Drawing Sheets**



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FIG. 1

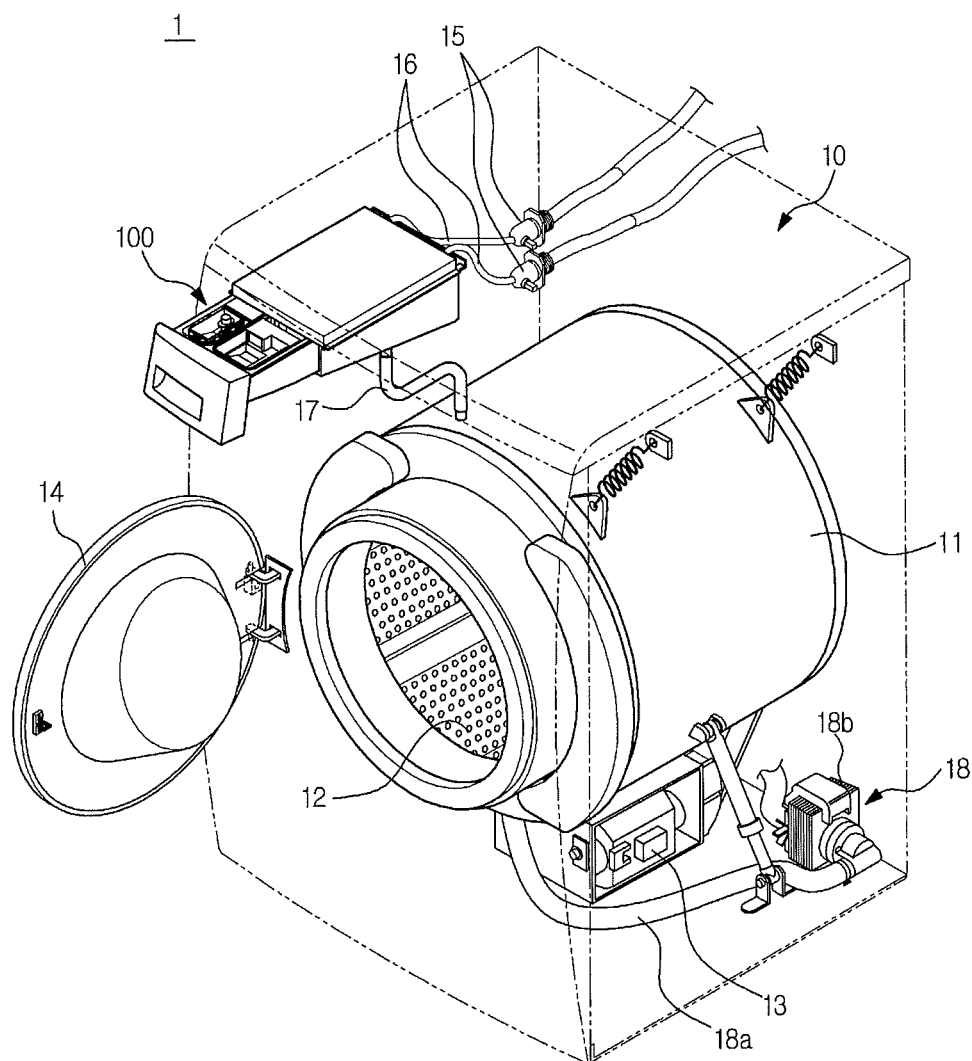


FIG. 2

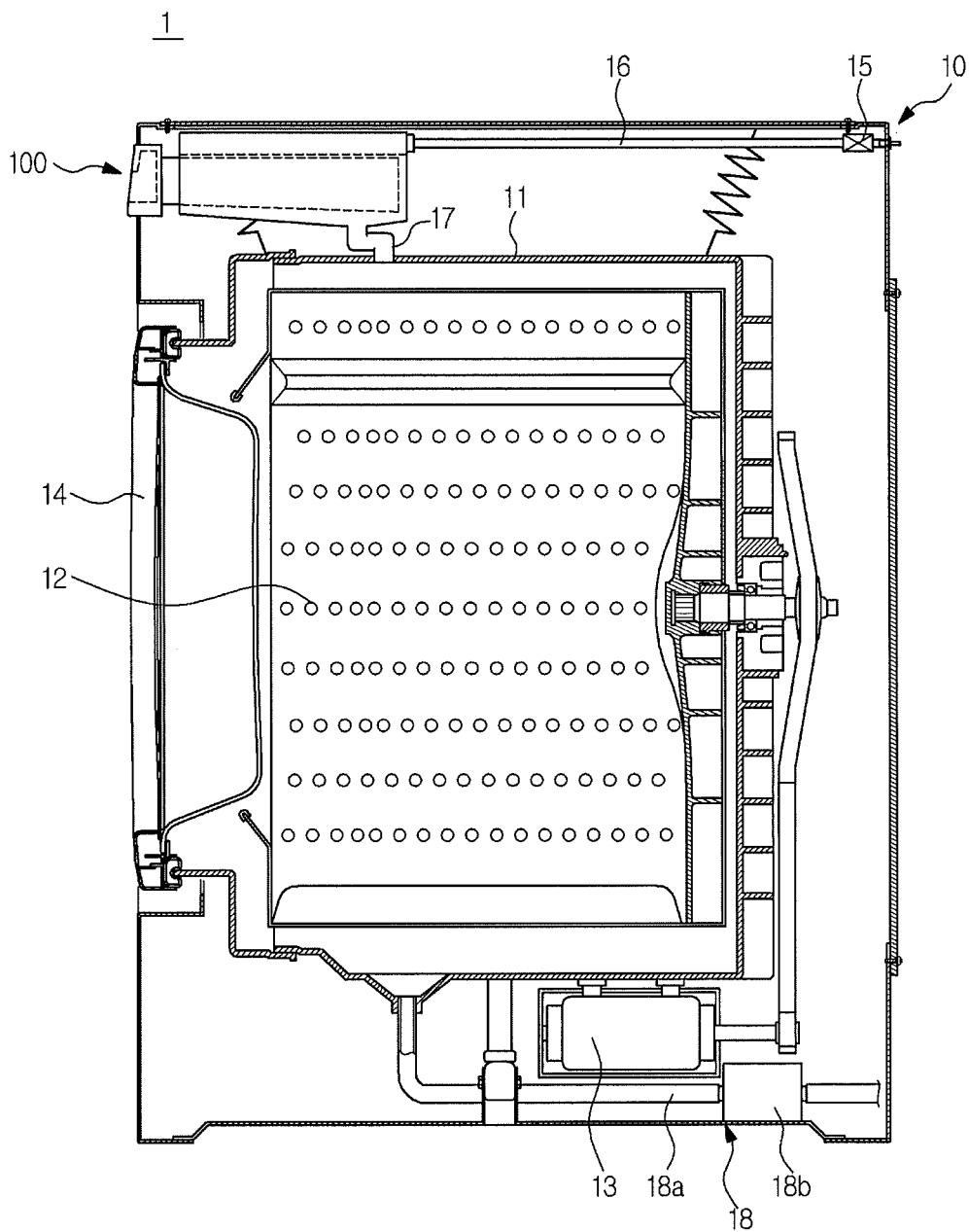


FIG. 3

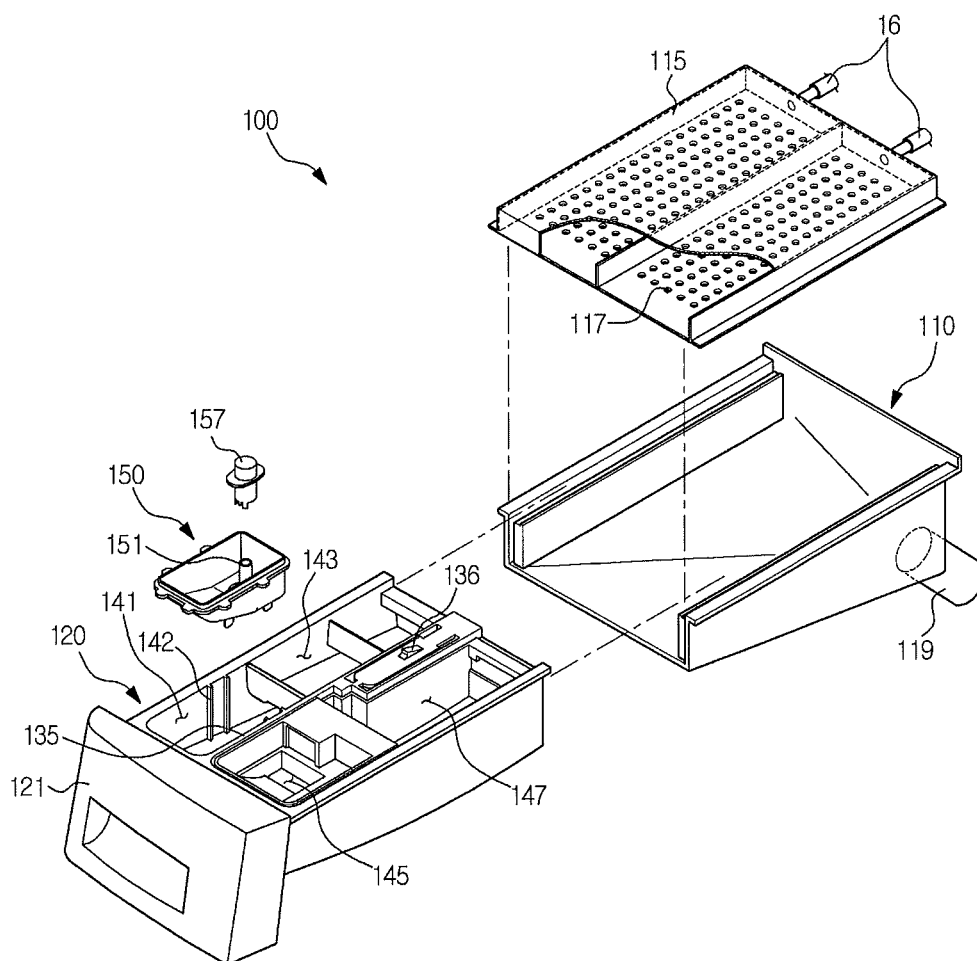


FIG. 4

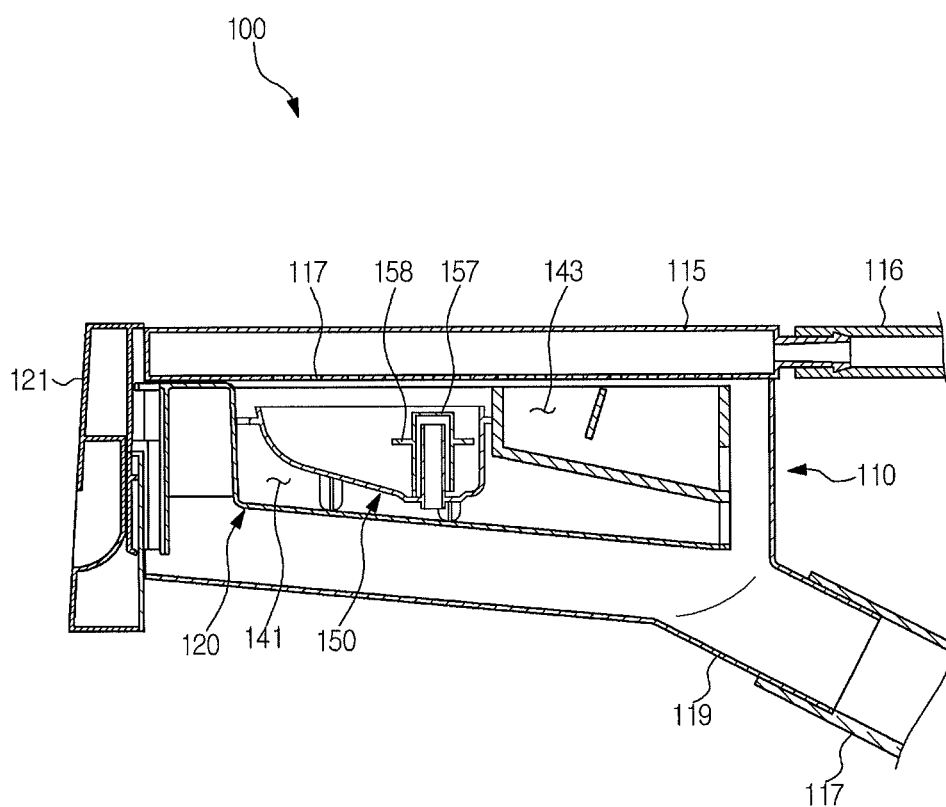


FIG. 5

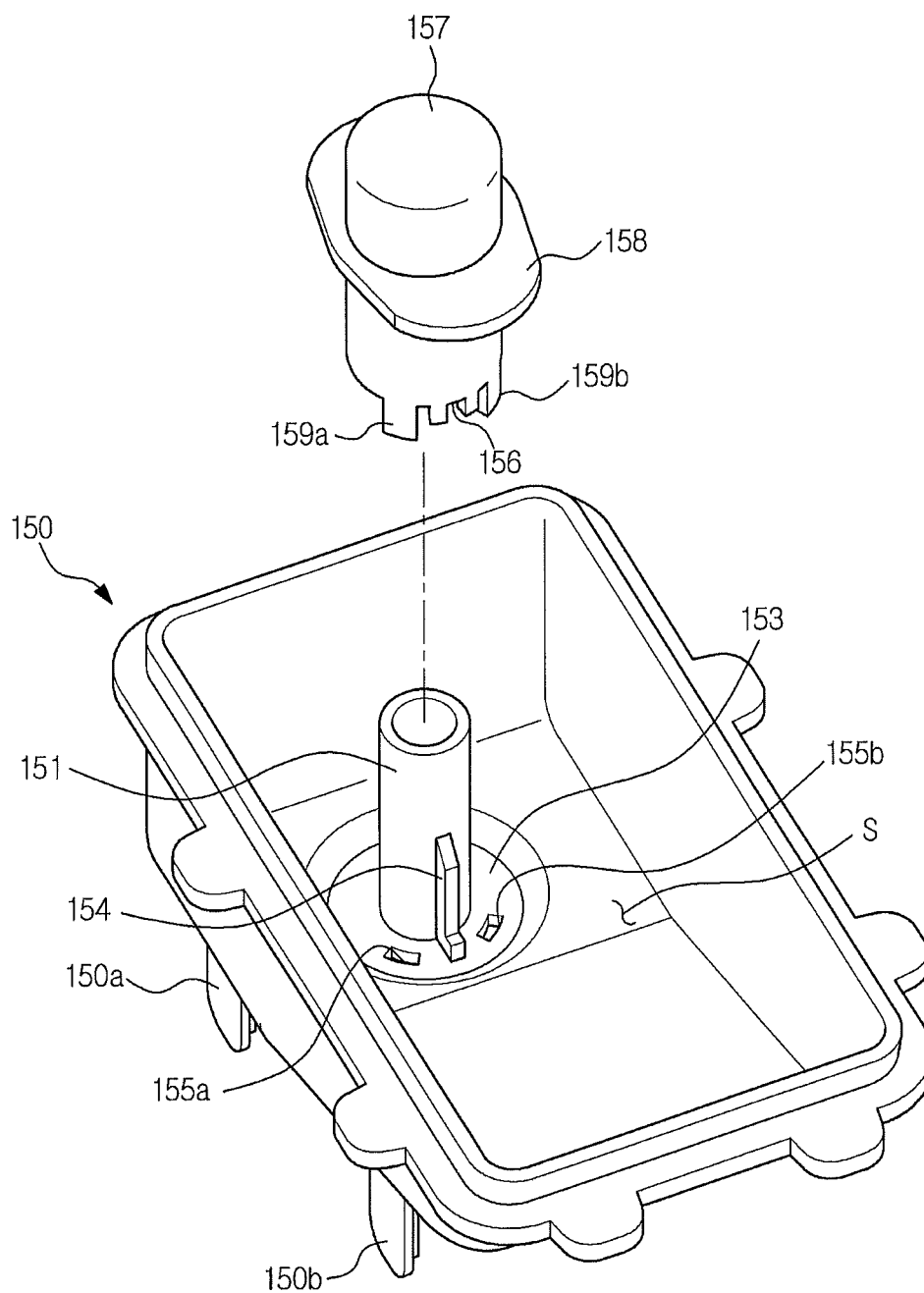


FIG. 6

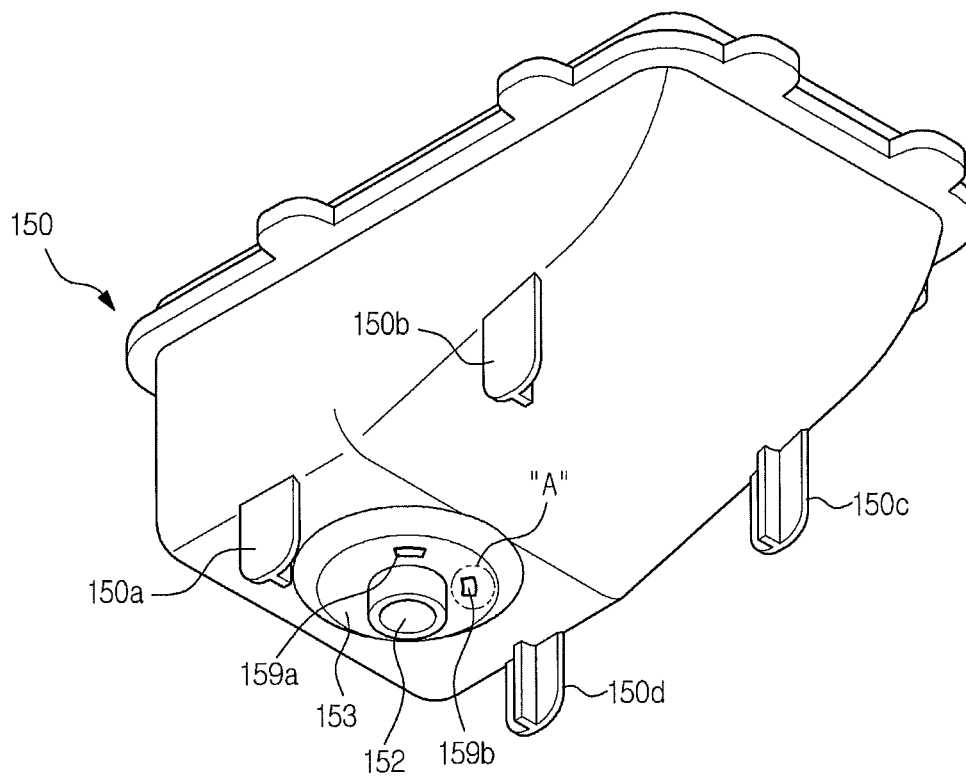




FIG. 7

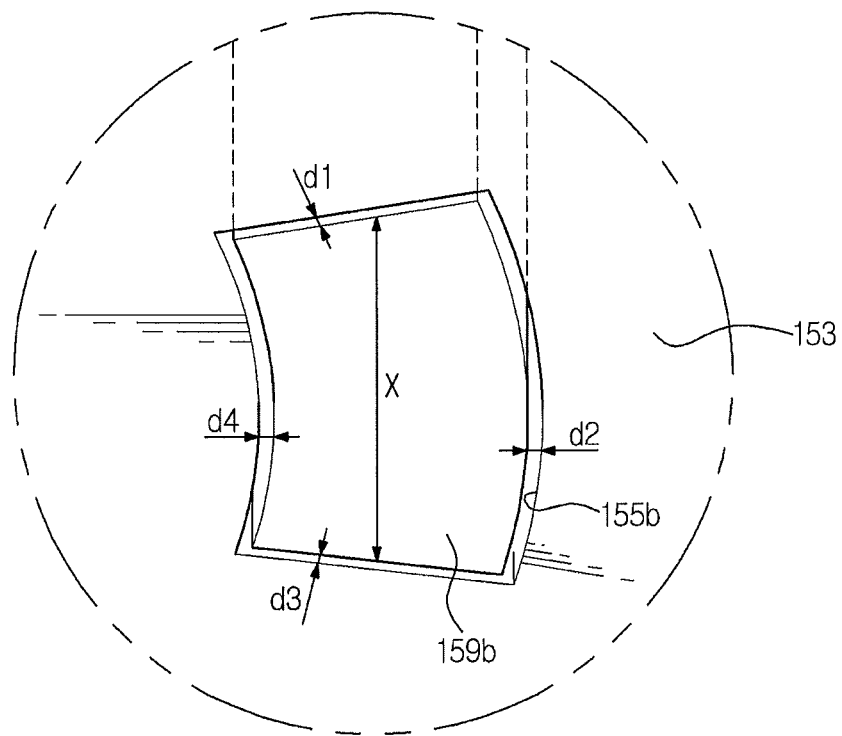


FIG. 8

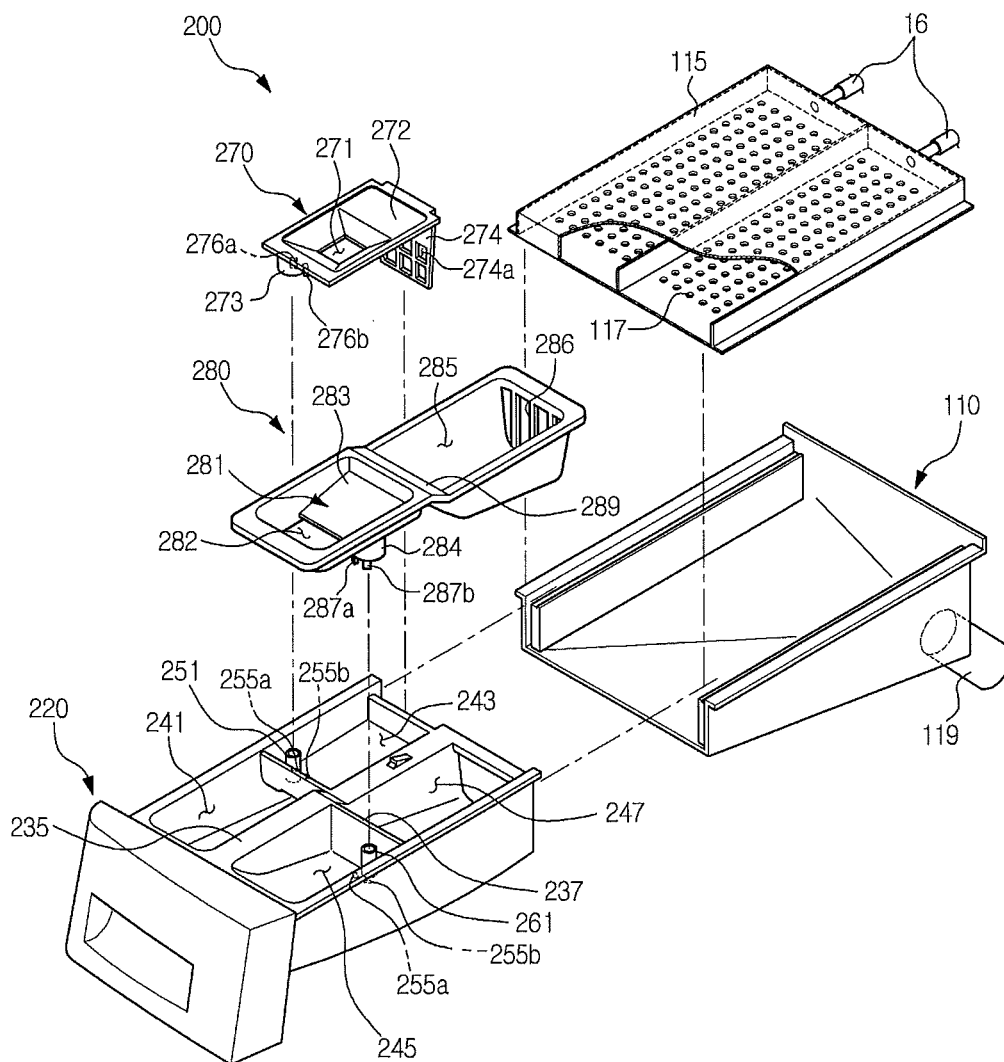
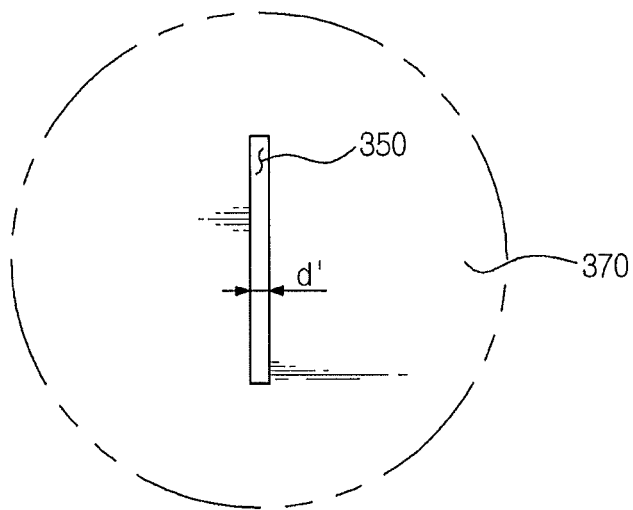


FIG. 9



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**DETERGENT SUPPLY APPARATUS AND  
WASHING MACHINE HAVING THE SAME****CROSS-REFERENCE TO RELATED  
APPLICATIONS**

This application is a divisional of U.S. application Ser. No. 12/926,162 filed on Oct. 28, 2010, which claims the benefit of Korean Patent Application No. 10-2009-0113644, filed on Nov. 24, 2009 in the Korean Intellectual Property Office, the disclosures of which are incorporated herein by reference.

**BACKGROUND****1. Field**

Embodiments relate to a detergent supply apparatus and a washing machine having the same wherein residual water is not present in a liquid detergent containing unit.

**2. Description of the Related Art**

Generally, a washing machine agitates laundry, wash water and a detergent in a washing tub using drive force of a motor to perform washing through friction therebetween.

The washing machine may include a detergent supply apparatus to supply a detergent to water to be supplied into a water tub such that the mixture of the detergent and the water is supplied into the water tub.

The detergent supply apparatus may include a detergent box, the interior of which is partitioned into sections such that different kinds of detergents are contained in the respective sections.

Also, a liquid detergent containing unit to contain a liquid detergent may be provided in the detergent box. The liquid detergent containing unit moves the liquid detergent diluted in the water using a siphon phenomenon. The liquid detergent containing unit may include a siphon pipe to induce a siphon action and a siphon cap coupled to the siphon pipe.

However, the siphon phenomenon occurs only at a predetermined level. Therefore, residual water is present in the liquid detergent containing unit at a level below the predetermined level.

Also, steam generated during steam washing or drying may be collected in the liquid detergent containing unit.

**SUMMARY**

It is an aspect to provide a detergent supply apparatus and a washing machine having the same wherein residual water is not present in a liquid detergent containing unit.

It is another aspect to provide a detergent supply apparatus and a washing machine having the same wherein the interior of a liquid detergent containing unit is kept clean.

Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

In accordance with one aspect, a detergent supply apparatus includes a detergent box and at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon, wherein the liquid detergent containing unit includes a siphon pipe to induce a siphon action, a siphon cap coupled to the siphon pipe, and at least one residual water hole formed through a bottom of the liquid detergent containing unit, the siphon cap includes at least one cap protrusion configured to be fitted into the residual water hole, and at least one gap is defined between the residual water hole and the cap protrusion such that residual water is discharged from the liquid detergent containing unit through the gap.

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The cap protrusion may protrude downward along part of a circumference of the siphon cap, and the residual water hole may have a shape corresponding to and greater than that of the cap protrusion.

The gap may be defined between at least one outer side of the cap protrusion and at least one inner side of the residual water hole.

The siphon pipe may be disposed at a center of a siphon installation part protruding downward from the bottom of the liquid detergent containing unit, and the residual water hole may be disposed at the siphon installation part at which the cap protrusion is mounted.

The gap may have a size of about 0.05 mm to about 0.5 mm.

The cap protrusion may have a length of about 3 mm to about 7 mm between opposite ends thereof.

The siphon pipe may protrude downward from the bottom of the liquid detergent containing unit to accelerate the siphon action.

The liquid detergent containing unit may include a separation type liquid detergent containing unit detachably provided in the detergent box.

The separation type liquid detergent containing unit may contain a main washing liquid detergent.

The liquid detergent containing unit may include at least one integral liquid detergent containing unit integrally provided in the detergent box.

The integral liquid detergent containing unit may include a main washing liquid detergent containing unit to contain a main washing liquid detergent, the siphon cap may include a cap liquid unit coupled to the siphon pipe, and the cap liquid unit may include a unit body having a supply hole to inject a liquid detergent, a first siphon cap provided at a bottom of the unit body, the first siphon cap being coupled to the siphon pipe, and a foreign matter filter extending downward from one end of the unit body.

The integral liquid detergent containing unit may include a rinse containing unit to contain a rinse or a decolorant, the siphon cap may include a rinse cap coupled to the siphon pipe, the rinse cap may include a rinse injection unit to inject a rinse and a reserve detergent containing unit to contain a reserve detergent, and the rinse injection unit may include a second siphon cap provided at a bottom thereof, the second siphon cap being coupled to the siphon pipe.

The reserve detergent containing unit may be integrally formed at a rear of the rinse cap.

In accordance with another aspect, a washing machine includes a cabinet, a detergent box detachably coupled into one side of the cabinet, and at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon, wherein the liquid detergent containing unit includes a siphon pipe to induce a siphon action, a siphon cap coupled to the siphon pipe, and a residual water removal unit to remove residual water from the liquid detergent containing unit, the residual water removal unit includes at least one residual water hole formed through a bottom of the liquid detergent containing unit, at least one cap protrusion provided at the siphon cap such that the cap protrusion is fitted into the residual water hole, and at least one residual water discharge unit formed between the residual water hole and the cap protrusion to function as a discharge channel through which residual water is discharged.

The cap protrusion may protrude downward along part of a circumference of the siphon cap, and the residual water hole may have a shape corresponding to and greater than that of the cap protrusion.

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The residual water discharge unit may be formed between at least one outer side of the cap protrusion and at least one inner side of the residual water hole.

A gap defined between at least one inner side of the residual water hole and at least one outer side of the cap protrusion may have a size of about 0.05 mm to about 0.5 mm.

The cap protrusion may have a length of about 3 mm to about 7 mm between opposite ends thereof.

The siphon pipe may protrude downward from the bottom of the liquid detergent containing unit to accelerate the siphon action.

In accordance with another aspect, a detergent supply apparatus includes a detergent box and at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon, wherein the liquid detergent containing unit includes a siphon pipe to induce a siphon action, a siphon cap coupled to the siphon pipe, and a water selection unit to select only water such that only the water passes therethrough, and the water selection unit includes at least one selection hole formed through a bottom of the liquid detergent containing unit, at least one cap protrusion configured to be fitted into the selection hole, and at least one selection gap unit formed between the selection hole and the cap protrusion such that only the water passes therethrough.

The cap protrusion may protrude downward along part of a circumference of the siphon cap, and the selection hole may have a sectional shape corresponding to and greater than that of the cap protrusion.

The selection gap unit may be formed between at least one outer side of the cap protrusion and at least one inner side of the selection hole.

A gap defined between the inner side of the selection hole and the outer side of the cap protrusion may have a size of about 0.05 mm to about 0.5 mm.

In accordance with a further aspect, a detergent supply apparatus includes a detergent box and at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon, wherein the liquid detergent containing unit includes at least one residual water hole formed through a bottom thereof and at least one hole insertion part configured to be inserted into the residual water hole, and at least one gap is defined between the residual water hole and the hole insertion part such that residual water is discharged from the liquid detergent containing unit through the gap.

The residual water hole may have a sectional shape corresponding to and greater than that of the hole insertion part.

The gap may be defined between at least one outer side of the hole insertion part and at least one inner side of the residual water hole.

The gap may have a size of about 0.05 mm to about 0.5 mm.

#### BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a perspective view illustrating a drum washing machine according to an embodiment;

FIG. 2 is a side sectional view of the drum washing machine of FIG. 1;

FIG. 3 is an exploded perspective view illustrating a detergent supply apparatus according to an embodiment;

FIG. 4 is a sectional view of the detergent supply apparatus of FIG. 3;

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FIG. 5 is a top perspective view illustrating a liquid detergent containing unit according to an embodiment;

FIG. 6 is a bottom perspective view of the liquid detergent containing unit;

FIG. 7 is a detailed view of part "A" of FIG. 6;

FIG. 8 is an exploded perspective view illustrating a detergent supply apparatus according to another embodiment; and

FIG. 9 is a detailed bottom view illustrating a liquid detergent containing unit according to another embodiment.

#### DETAILED DESCRIPTION

Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. 1 is a perspective view illustrating a drum washing machine 1 according to an embodiment. FIG. 2 is a side sectional view of the drum washing machine 1 of FIG. 1.

As shown in FIGS. 1 and 2, the drum washing machine 1 includes a cabinet 10 forming the external appearance thereof, a tub 11 mounted in the cabinet 10 to contain wash water, a cylindrical drum 12 rotatably mounted in the tub 11, the drum 12 having a plurality of spin-drying holes formed at a wall thereof, and a drive motor to rotate the drum 12 in alternating directions such that washing, rinsing and spin-drying operations are performed in the drum 12.

At the tub 11 and the drum 12 are formed openings through which laundry is introduced or removed in front of the cabinet 10. To the front of the cabinet 10 is hingedly coupled a door 14 to open and close the openings.

At the rear of the cabinet 10 is mounted a water supply valve 15 through which wash water is supplied from the outside of the cabinet 10. A detergent supply apparatus 100 is mounted at the front of the cabinet 10. A water supply hose 16 is connected between the water supply valve 15 and the detergent supply apparatus 100.

Water, introduced through the water supply valve 15, is supplied to the detergent supply apparatus 100 through the water supply hose 16. In the detergent supply apparatus 100, the water is mixed with a detergent. The mixture, i.e., wash water, is introduced into the tub 11 through a connection pipe 17.

Below the tub 11 is provided a drainage unit 18 to forcibly drain the wash water from the tub 11 out of the cabinet 10 after the completion of washing. The drainage unit 18 includes a drainage hose 18a and a drainage pump 18b.

FIG. 3 is an exploded perspective view illustrating a detergent supply apparatus 100 according to an embodiment. FIG. 4 is a sectional view of the detergent supply apparatus 100 of FIG. 3.

As shown in FIGS. 3 and 4, the detergent supply apparatus 100 includes a box-shaped housing 110 open at the front thereof and a detergent box 120 detachably coupled into the housing 110 through the open front of the housing 110.

The detergent supply apparatus 100 is disposed at the upper-side front of the cabinet 10 such that the detergent box 120 is opened and closed in a drawer fashion outside the cabinet 10.

In the housing 110 is provided a space to receive the detergent box 120. The housing 110 is open at the front and top thereof.

A water supply case 115 is coupled to the open top of the housing 110. The water supply case 115 is connected to the water supply hose 16. The water supply case 115 has a plurality of through holes 117 through which wash water is supplied to the detergent box 120.

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At the rear of the housing **110** is formed an outflow port **119** through which water introduced through the through holes **117** of the water supply case **115** is supplied into the tub **11** together with a detergent contained in the detergent box **120** through the connection pipe **17**.

The bottom of the housing **110** is inclined such that the detergent and the water flow to the outflow port **119**. A mixture of the detergent and the water is supplied into the tub **11** through the connection pipe **17** connected to the outflow port **119**.

At the front of the detergent box **120** is provided a grip **121** to allow a user to insert and withdraw the detergent box **120**.

The interior of the detergent box **120** is partitioned into left and right sections by a partition **135**. At the top of the partition **135** is provided a catch **136** to couple the detergent box **120** to the housing **110**.

In the front part of the left section of the detergent box **120** is provided a main washing detergent containing unit **141** to contain a main washing detergent. In the rear part of the left section of the detergent box **120** is provided a reserve detergent containing unit **143** to contain a reserve detergent.

The main washing detergent containing unit **141** contains a main washing powder detergent. The bottom of the main washing detergent containing unit **141** is inclined such that a mixture of a powder detergent and water flows to the outflow port **119**.

An additional liquid detergent containing unit **150** may be mounted in the main washing detergent containing unit **141**. That is, a user may put a powder detergent in the main washing detergent containing unit **141** to perform washing using the powder detergent. The user may mount the liquid detergent containing unit **150** in the main washing detergent containing unit **141** and inject a liquid detergent into the liquid detergent containing unit **150** to perform washing using the liquid detergent.

In this embodiment, the liquid detergent containing unit **150** is configured in a detachable structure in which the liquid detergent containing unit **150** is fitted in guide rails **142** formed at the inner wall of the main washing detergent containing unit **141**. Details of the liquid detergent containing unit **150** will be described later.

The reserve detergent containing unit **143** is provided at the upper part of the rear of the main washing detergent containing unit **141** to contain a reserve powder detergent and supply a mixture of the reserve powder detergent and water to the outflow port **119**.

In the front part of the right section of the detergent box **120** is provided a rinse containing unit **145** to contain a rinse. In the rear part of the right section of the detergent box **120** is provided a decolorant containing unit **147** to contain a decolorant.

The rinse containing unit **145** contains a rinse or a fabric softener. In the rinse containing unit **145** is provided a siphon pipe (not shown) to supply the rinse to the outflow port **119** using a siphon phenomenon.

The decolorant containing unit **147** contains a decolorant. In the decolorant containing unit **147** is provided a siphon pipe (not shown) to supply the decolorant to the outflow port **119** using a siphon phenomenon.

FIG. **5** is a top perspective view illustrating a liquid detergent containing unit **150** according to an embodiment. FIG. **6** is a bottom perspective view of the liquid detergent containing unit **150**. FIG. **7** is a detailed view of part "A" of FIG. **6**.

As shown in FIGS. **5** and **6**, a containing space **S** to contain a liquid detergent is provided in the liquid detergent containing unit **150**. The liquid detergent containing unit **150** includes a siphon pipe **151** provided at the rear part of the

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containing space **S** to induce a siphon phenomenon and a siphon cap **157** coupled to the siphon pipe **151**.

At opposite sides of the bottom of the liquid detergent containing unit **150** are provided detergent containing unit legs **150a**, **150b**, **150c** and **150d** to separate the containing space **S** from the bottom of the main washing detergent containing unit **141**. A gap is defined between the liquid detergent containing unit **150** and the main washing detergent containing unit **141** by the provision of the detergent containing unit legs **150a**, **150b**, **150c** and **150d**, with the result that the detergent and the water discharged from the siphon pipe **151** due to the siphon phenomenon easily flow to the outflow port **119**.

The siphon pipe **151** is provided in a siphon installation part **153** at the bottom of the liquid detergent containing unit **150**. The siphon installation part **153** protrudes downward from the bottom of the liquid detergent containing unit **150** in the shape of a circle.

The siphon pipe **151** protrudes upward from the center of the siphon installation part **153**. Also, the siphon pipe **151** includes an extension **152** protruding downward from the bottom of the siphon installation part **153**. The extension **152** is provided to accelerate a siphon action in the containing space **S**.

The siphon cap **157** is coupled to the siphon pipe **151** to induce the siphon phenomenon through interaction between the siphon cap **157** and the siphon pipe **151**.

The siphon cap **157** is open at the lower end thereof to surround the siphon pipe **151**. The siphon cap **157** has a larger outer diameter than the siphon pipe **151**.

From the side of the siphon cap **157** protrudes a limit level indicator **158** to indicate a limit injection level of a liquid detergent. The limit level indicator **158** serves to inform a user of a limit of a liquid detergent to be injected in a state in which the siphon cap **157** is coupled to the siphon pipe **151**. If the level of the injected liquid detergent exceeds the limit level indicator **158**, a siphon phenomenon occurs, with the result that the liquid detergent to be supplied during washing is previously discharged through the siphon pipe **151**.

The coupling between the siphon pipe **151** and the siphon cap **157** is achieved by fitting a siphon guide **154** formed at the side of the siphon pipe **151** into a siphon groove **156** formed at the lower end of the siphon cap **157**.

One or more residual water holes **155a** and **155b** are formed through the siphon installation part **153** around the siphon pipe **151**. The residual water holes **155a** and **155b** have shapes corresponding to those of cap protrusions **159a** and **159b** of the siphon cap **157** such that the cap protrusions **159a** and **159b** are fitted in the residual water holes **155a** and **155b**, respectively.

The cap protrusions **159a** and **159b** are formed at the lower end of the siphon cap **157** such that cap protrusions **159a** and **159b** are fitted in the residual water holes **155a** and **155b**, respectively. The cap protrusions **159a** and **159b** protrude downward along part of the circumference of the siphon cap **157**. In this embodiment, two cap protrusions **159a** and **159b** are provided. A line **X** interconnecting opposite ends of each of the cap protrusions **159a** and **159b** has a length of 3 mm to 7 mm. In this embodiment, the line **X** has a length of 5 mm.

The residual water holes **155a** and **155b**, in which the cap protrusions **159a** and **159b** are fitted, have sectional shapes corresponding to and greater than those of the cap protrusions **159a** and **159b**. The residual water holes **155a** and **155b** are equal in number to the cap protrusions **159a** and **159b**. One or more residual water holes **155a** and **155b** and one or more cap protrusions **159a** and **159b** are provided.

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When the siphon cap **157** is coupled to the siphon pipe **151**, the cap protrusions **159a** and **159b** are fitted into the residual water holes **155a** and **155b**, respectively. Between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b** are defined one or more gaps **d1**, **d2**, **d3** and **d4** through which residual water is discharged from the liquid detergent containing unit **150**.

The gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b** are 0.05 mm to 0.5 mm. The gaps **d1**, **d2**, **d3** and **d4** may be 0.1 mm.

A liquid detergent has a higher viscosity than water. Consequently, the liquid detergent is not discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b**, but water is discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b**.

In the related art, the supply of a mixture of a liquid detergent and water due to a siphon phenomenon is performed only at the height corresponding to the lower end of the siphon cap, with the result that a mixture of a liquid detergent and water (most of the mixture is water) present at a level lower than the height corresponding to the lower end of the siphon cap is discharged outside only by a user emptying the liquid detergent containing unit.

In this embodiment, on the other hand, a liquid detergent injected into the liquid detergent containing unit **150** is not discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b**, and residual water (containing a small percentage of the liquid detergent) present on the siphon installation part **153** after the supply of the liquid detergent and water due to a siphon phenomenon with the progress of washing is discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b** because the residual water has a lower viscosity than the liquid detergent.

As shown in FIG. 7, the gaps **d1**, **d2**, **d3** and **d4** may be defined between outer sides of the cap protrusion **159b** and inner sides of the residual water hole **155b**. Alternatively, at least one gap may be defined between at least one of the outer sides of the cap protrusion **159b** and at least one of the inner sides of the residual water hole **155b**. In this case, **d1** and **d2** may be 0.1 mm and **d3** and **d4** may be 0 mm.

Also, the gaps **d1**, **d2**, **d3** and **d4** may have the same size or different sizes. In this case, the gaps **d1**, **d2**, **d3** and **d4** may be 0.05 mm to 0.5 mm.

In this embodiment, the cap protrusions **159a** and **159b** are provided at the lower end of the siphon cap **157**. Alternatively, the cap protrusions **159a** and **159b** may be configured as hole insertion parts which are inserted into the residual water holes **155a** and **155b**. The hole insertion parts may not be included in the siphon cap **157**. The hole insertion parts may be included as an arbitrary component of the liquid detergent containing unit **150** or provided as an independent component as long as the hole insertion parts are inserted into the residual water holes **155a** and **155b** to define the gaps **d1**, **d2**, **d3** and **d4** therebetween.

Hereinafter, a process of discharging residual water from the liquid detergent containing unit **150** according to an embodiment of the present invention will be described.

When a user wishes to perform washing using a liquid detergent, the user mounts the liquid detergent containing unit **150** in the main washing detergent containing unit **141** and injects the liquid detergent into the liquid detergent con-

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taining unit **150**. At this time, the liquid detergent is injected so as not to exceed the limit level indicator **158**.

In a state in which only the liquid detergent is injected, the liquid detergent is not discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b** because the viscosity of the liquid detergent is high. Also, a siphon phenomenon does not occur.

With the progress of washing, water introduced through the water supply valve **15** and the water supply hose **16** is supplied into the detergent box **120** through the water supply case **115**. The water is mixed with the liquid detergent in the liquid detergent containing unit **150**. As the level of the mixture of the liquid detergent and the water rises, the mixture exceeds the upper end of the siphon pipe **151**, with the result that a siphon phenomenon occurs. Consequently, the mixture is discharged through the siphon pipe **151** and flows to the outflow port **119**.

The supply of the mixture of the liquid detergent and the water due to the siphon phenomenon is performed only at the height (i.e., the height from the siphon installation part **153** to the lower end of the siphon cap **157**) corresponding to the lower end of the siphon cap **157**, and the mixture of the liquid detergent and the water (most of the mixture is water) may be present on the siphon installation part **153** at a level lower than the height corresponding to the lower end of the siphon cap. Such residual water is discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b**, with the result that no residual water is present in the liquid detergent containing unit **150**.

That is, the residual water holes **155a** and **155b**, the cap protrusions **159a** and **159b**, and the gaps **d1**, **d2**, **d3** and **d4** defined between the residual water holes **155a** and **155b** and the cap protrusions **159a** and **159b** constitute a residual water removal unit to remove residual water from the liquid detergent containing unit **150**. In addition, the gaps **d1**, **d2**, **d3** and **d4** defined between the residual water holes **155a** and **155b** and the cap protrusions **159a** and **159b** serve as a residual water discharge unit constituting residual water discharge channels.

That is, the gaps **d1**, **d2**, **d3** and **d4** defined between the residual water holes **155a** and **155b** and the cap protrusions **159a** and **159b** constitute a water selection unit to select only water such that only the water passes therethrough, the residual water holes **155a** and **155b** serve as selection holes **155a** and **155b** to select water, and the gaps **d1**, **d2**, **d3** and **d4** defined between the residual water holes **155a** and **155b** and the cap protrusions **159a** and **159b** serve as a selection gap unit to allow only water to pass therethrough.

During steam washing or drying in addition to washing, steam is generated in the tub **11**, and the steam flows back to be collected in the liquid detergent containing unit **150** in the form of water. Such residual water is discharged through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b**, with the result that no residual water is present in the liquid detergent containing unit **150**.

The structure in which the residual water is discharged from the liquid detergent containing unit **150** through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a** and **159b** and the residual water holes **155a** and **155b** may be applied to all kinds of liquid detergent containing units to supply liquid detergents using a siphon phenomenon.

Hereinafter, a detergent supply apparatus according to another embodiment of the present invention will be

described. The same components of this embodiment as those of the previous embodiment will not be described.

FIG. 8 is an exploded perspective view illustrating a detergent supply apparatus 200 according to another embodiment of the present invention.

As shown in FIG. 8, the detergent supply apparatus 200 includes a box-shaped housing 110 open at the front thereof and a detergent box 220 detachably coupled into the housing 110 through the open front of the housing 110.

The housing 110 and a water supply case 115 coupled to the housing 110 have the same structures as those of the previous embodiment.

In the previous embodiment, the liquid detergent containing unit 150 is detachably mounted in the detergent box 120. In this embodiment, liquid detergent containing units 243 and 245 are integrally formed in the detergent box 220. That is, a first liquid detergent containing unit 243 and a second liquid detergent containing unit 245 are integrally mounted in the detergent box 220, which will be hereinafter described in detail.

The interior of the detergent box 220 is partitioned into a plurality of sections by partitions 235 and 237 such that different kinds of detergents are contained in the respective sections.

The first partition 235 partitions the interior of the detergent box 220 into left and right sections.

In the left section of the detergent box 220 is provided a powder detergent containing unit 241 to contain a main washing powder detergent.

In the rear upper part of the powder detergent containing unit 241 is provided a first liquid detergent containing unit 243 to contain a main washing liquid detergent.

The first liquid detergent containing unit 243 is integrally formed in the powder detergent containing unit 241.

The first liquid detergent containing unit 243 is separated from the bottom of the powder detergent containing unit 241 by a predetermined distance such that a powder detergent flows to the outflow port 119 together with water.

In the first liquid detergent containing unit 243 is provided a first siphon pipe 251 to induce a siphon action. The first siphon pipe 251 is formed such that a mixture of a detergent and water flows to the outflow port 119 through a channel defined in the center of the first siphon pipe 251.

To the first siphon pipe 251 is coupled a cap liquid unit 270 to induce a siphon action.

Consequently, the main washing liquid detergent in the first liquid detergent containing unit 243 flows to the powder detergent containing unit 241 through the internal channel of the first siphon pipe 251 and is supplied to the outflow port 119 of the housing 110.

The cap liquid unit 270 includes a unit body 272 having a supply hole 271 to supply a liquid detergent, a first siphon cap 273 formed at one side of the bottom of the unit body 272, and a foreign matter filter 274.

The first siphon cap 273 is formed in the shape of a cylinder closed at the top thereof to surround the first siphon pipe 251 of the first liquid detergent containing unit 243.

The foreign matter filter 274 is bent downward from the side of the unit body 272 opposite to the first siphon cap 273. The foreign matter filter 274 has a plurality of through holes 274a having a predetermined width to filter foreign matter when discharging a detergent and water.

In the same manner as the previous embodiment, the first siphon cap 273 is provided with first cap protrusions 276a and 276b, and the first liquid detergent containing unit 243 is provided at the bottom thereof with first residual water holes 255a and 255b, which are fitted in the first cap protrusions

276a and 276b, respectively. Between the first cap protrusions 276a and 276b and the first residual water holes 255a and 255b are defined gaps (not shown) through which residual water is discharged from the first liquid detergent containing unit 243.

The size and shape of the gaps defined between the first cap protrusions 276a and 276b and the first residual water holes 255a and 255b are the same as those of the previous embodiment. Also, the principle and process of discharging residual water through the gaps defined between the first cap protrusions 276a and 276b and the first residual water holes 255a and 255b are the same as those of the previous embodiment.

The right section of the detergent box 220 is partitioned into two sections by the second partition 237.

In the front right section of the detergent box 220 is provided a second liquid detergent containing unit 245 to contain a rinse or a fabric softener. In the rear right section of the detergent box 220 is provided a mounting space 247 in which a reserve detergent containing unit 285, which will be described later, is mounted.

The second liquid detergent containing unit 245 is integrally formed in the detergent box 220 to contain a rinse or a decolorant.

In the second liquid detergent containing unit 245 is provided a second siphon pipe 261 to induce a siphon action. The second siphon pipe 261 is formed such that a mixture of a detergent and water flows to the outflow port 119 of the housing 110 through a channel defined in the center of the second siphon pipe 261.

A rinse cap 280 is coupled to the tops of the second liquid detergent containing unit 245 and the mounting space 247.

The rinse cap 280 includes a rinse injection unit 281 to inject a rinse and a reserve detergent containing unit 285 to contain a reserve washing powder detergent.

The rinse injection unit 281 of the rinse cap 280 is coupled to the second liquid detergent containing unit 245 of the detergent box 220. The reserve detergent containing unit 285 is coupled to the mounting space 247.

The rinse injection unit 281 and the reserve detergent containing unit 285 are connected to each other through a connection part 289.

The rinse injection unit 281 includes a rinse injection hole 282 to inject a rinse, a rinse injection plate 283 forming the rinse injection hole 282, and a second siphon cap 284 protruding downward from one side of the rinse injection plate 283.

The second siphon cap 284 is formed in the shape of a cylinder closed at the top thereof to surround the second siphon pipe 261. The second siphon cap 284 has a larger diameter than the second siphon pipe 261 such that a channel is defined between the inner circumference of the second siphon cap 284 and the outer circumference of the second siphon pipe 261.

The reserve detergent containing unit 285 has a size sufficient to be fitted in the mounting space 247. At the rear of the reserve detergent containing unit 285 is formed a detergent discharge port 35 through which a reserve detergent is discharged.

In the same manner as the previous embodiment, the second siphon cap 284 is provided with second cap protrusions 287a and 287b, and the second liquid detergent containing unit 245 is provided at the bottom thereof with second residual water holes 265a and 265b, which are fitted in the second cap protrusions 287a and 287b, respectively. Between the second cap protrusions 287a and 287b and the second residual water holes 265a and 265b are defined gaps (not



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shown) through which residual water is discharged from the second liquid detergent containing unit **245**.

The size and shape of the gaps defined between the second cap protrusions **287a** and **287b** and the second residual water holes **265a** and **265b** are the same as those of the previous embodiment. Also, the principle and process of discharging residual water through the gaps defined between the second cap protrusions **287a** and **287b** and the second residual water holes **265a** and **265b** are the same as those of the previous embodiment.

Hereinafter, a liquid detergent containing unit according to another embodiment of the present invention will be described. The same components of this embodiment as those of the previous embodiment will not be described.

FIG. 9 is a detailed bottom view illustrating a liquid detergent containing unit according to another embodiment.

In the previous embodiments, residual water is selectively discharged from the liquid detergent containing units **150**, **243** and **245** through the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a**, **159b**, **276a**, **276b**, **287a** and **287b** and the residual water holes **155a**, **155b**, **255a**, **255b**, **265a** and **265b**. In this embodiment, a residual water discharge slit **350** may be provided instead of the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a**, **159b**, **276a**, **276b**, **287a** and **287b** and the residual water holes **155a**, **155b**, **255a**, **255b**, **265a** and **265b**.

That is, the cap protrusions **159a**, **159b**, **276a**, **276b**, **287a** and **287b** are not fitted in the residual water holes **155a**, **155b**, **255a**, **255b**, **265a** and **265b**, but the residual water discharge slit **350** selectively discharges residual water excluding a liquid detergent. Consequently, the residual water discharge slit **350** performs the same function as the gaps **d1**, **d2**, **d3** and **d4** defined between the cap protrusions **159a**, **159b**, **276a**, **276b**, **287a** and **287b** and the residual water holes **155a**, **155b**, **255a**, **255b**, **265a** and **265b** in the previous embodiments.

In this case, the residual water discharge slit **350** may be disposed at any position of the bottom **370** of the liquid detergent containing unit. The residual water discharge slit **350** may be disposed at the lowest position of the bottom **370** of the liquid detergent containing unit since residual water is present at the lowest height of the liquid detergent containing unit. In a structure in which the bottom **370** of the liquid detergent containing unit is inclined, the residual water discharge slit **350** is disposed at the lower part of the inclined bottom **370**.

The residual water discharge slit **350** may have a width **d'** of 0.05 mm to 0.5 mm. The width **d'** may be 0.1 mm.

As is apparent from the above description, residual water is discharged from the liquid detergent containing unit through the gaps defined between the residual water holes and the cap protrusions in the detergent supply apparatus and the washing machine having the same.

Also, the interior of the liquid detergent containing unit is kept clean.

Although a few embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A detergent supply apparatus comprising:

a detergent box; and

at least one liquid detergent containing unit provided in the detergent box to move a liquid detergent using a siphon phenomenon,

wherein the liquid detergent containing unit comprises a siphon pipe to induce a siphon action, a siphon cap

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coupled to the siphon pipe, and at least one residual water hole formed through a bottom of the liquid detergent containing unit,

the siphon cap comprises at least one cap protrusion configured to be fitted into the residual water hole and a cap liquid unit coupled to the siphon pipe,

at least one gap is defined between the residual water hole and the cap protrusion such that residual water is discharged from the liquid detergent containing unit through the gap,

the liquid detergent containing unit comprises at least one integral liquid detergent containing unit integrally provided in the detergent box, and

the cap liquid unit comprises a unit body having a supply hole to inject the liquid detergent, a first siphon cap provided at a bottom of the unit body, the first siphon cap being coupled to the siphon pipe, and a foreign matter filter extending downward from one end of the unit body.

2. The detergent supply apparatus according to claim 1, wherein the cap protrusion protrudes downward along part of a circumference of the siphon cap, and the residual water hole has a shape corresponding to that of the cap protrusion.

3. The detergent supply apparatus according to claim 2, wherein the gap is defined between at least one outer side of the cap protrusion and at least one inner side of the residual water hole.

4. The detergent supply apparatus according to claim 2, wherein the cap protrusion has a length of about 3 mm to about 7 mm between opposite ends thereof.

5. The detergent supply apparatus according to claim 1, wherein

the siphon pipe is disposed at a center of a siphon installation part protruding downward from the bottom of the liquid detergent containing unit, and

the residual water hole is disposed at the siphon installation part at which the cap protrusion is mounted.

6. The detergent supply apparatus according to claim 1, wherein the gap has a size of about 0.05 mm to about 0.5 mm.

7. The detergent supply apparatus according to claim 1, wherein the siphon pipe protrudes downward from the bottom of the liquid detergent containing unit to accelerate the siphon action.

8. The detergent supply apparatus according to claim 1, wherein the integral liquid detergent containing unit comprises a main washing liquid detergent containing unit to contain a main washing liquid detergent.

9. The detergent supply apparatus according to claim 1, wherein

the integral liquid detergent containing unit comprises a rinse containing unit to contain a rinse or a decolorant,

the siphon cap comprises a rinse cap coupled to the siphon pipe,

the rinse cap comprises a rinse injection unit to inject a rinse and a reserve detergent containing unit to contain a reserve detergent, and

the rinse injection unit comprises a second siphon cap provided at a bottom thereof, the second siphon cap being coupled to the siphon pipe.

10. The detergent supply apparatus according to claim 9, wherein the reserve detergent containing unit is integrally formed at a rear of the rinse cap.